Automatic Standby Technology Can Significantly Reduce Risk of Patient Injury and Surgical Drape Burns From Nasal Endoscopes

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Introduction

Operating room fires are serious safety events that can harm both patients and caregivers. Burn injuries and surgical drape fires are known potential complications of surgery using endoscopes. Risk of cutaneous burns occurs around temperatures of 50°C. Areas of potential danger include the endoscope tip, and more importantly, the end of the light cable which can cause thermal damage when accidentally disconnected from the endoscope. Automatic standby technology (AST) (Safelight® by Stryker, Kalamazoo, MI, USA) triggers the light source to immediately enter standby mode when the light cable is disconnected from the endoscope, which should reduce the likelihood of burn injuries and drape fires. This study interrogated this new technology versus a conventional light source (Karl Storz, Tuttlingen, Germany) comparing temperature differences at the endoscope tip and adapter, as well as the propensities of disconnected light cables to burn surgical drapes.

Methods

- AST and conventional light sources with standard light cables connected to a standard 4 mm rigid nasal endoscope (Karl Storz, Tuttlingen, Germany)
- Temperature measured using a thermocouple sensor at scope tip to compare AST and conventional light sources (112 time points at 15 second intervals)
- Temperature at adapter measured comparing AST with the conventional light source (52 time points at 15 second intervals)
- Thermal camera used to assess temperature of light cable ends immediately upon disconnection
- Finally, light cords were held to standard surgical drapes immediately after disconnection for various times (range: 1 to 60 sec) both with direct and indirect contact (5 mm away from the drape)

Results

- Average temperature at scope tip was 24.0°C for AST and 25.2°C for conventional light source ($p < 0.001$)
- Average temperature at adapter was 26.6°C for AST and 27.3°C for conventional ($p = 0.003$)
- Upon disconnection of the light cable, cable end temperature averaged 40.9°C for cables attached to AST, versus 56.8°C for conventional light sources
- Conventional light cords showed notable drape burns at all time intervals with both direct and indirect contact, and damage was significantly greater with indirect contact via thermal radiation
- AST system did not burn the drapes with either direct or indirect contact

Figures

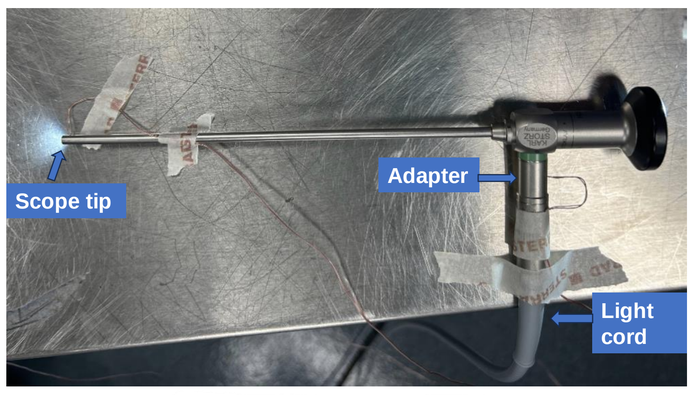


Figure 1: Nasal endoscope with attached light cord showing location of thermocouple sensors (tip and adapter)

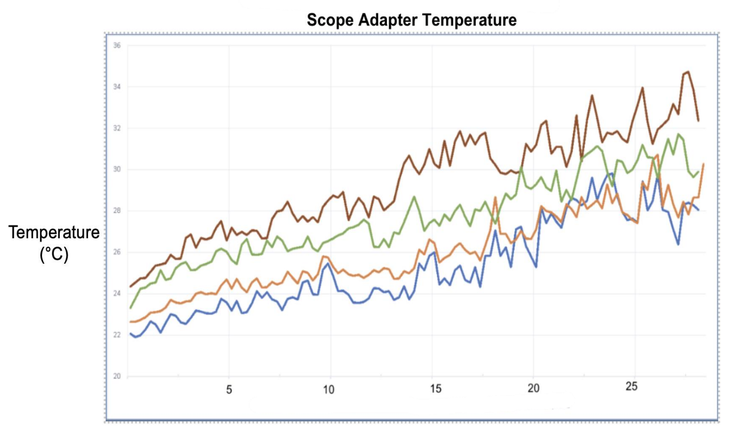


Figure 2: Comparison of Scope adapter temperature between conventional and AST light sources

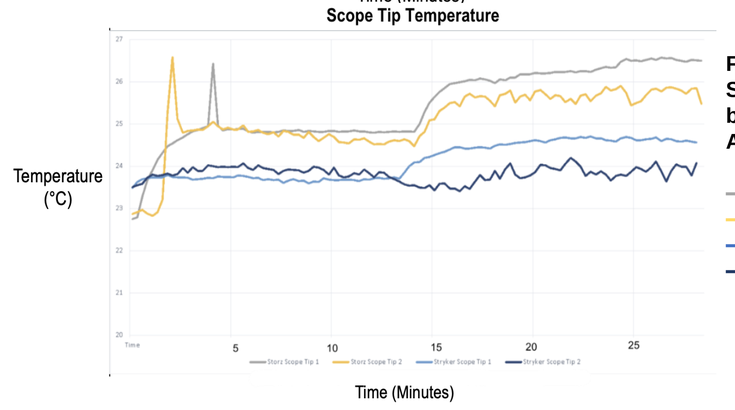
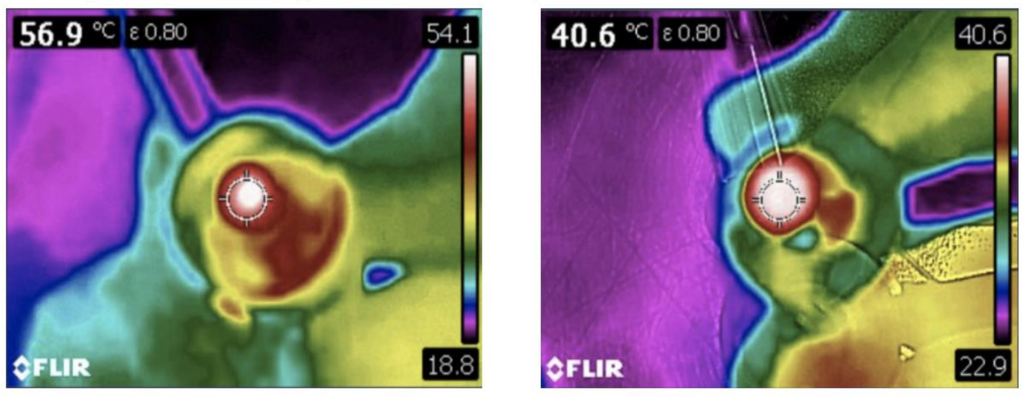


Figure 3: Comparison of Scope tip temperature between conventional and AST light sources



Conventional AST

Figure 4: Thermal camera view of light cable end temperatures immediately upon disconnection for conventional (left) and AST (right)

Discussion

- Both scope tip and adapter were cooler using AST technology compared to conventional light sources, though they did not meet the 50°C skin burn threshold
- Immediately upon disconnection, temperature of light cord end was much lower with AST compared to conventional and dropped well below 50°C
- On disconnection from conventional light sources, light cables produced significant burns in drapes at all time intervals, most significantly on indirect contact, while AST did not cause burns to surgical drapes with direct or indirect contact
- Radiative heat transfer, as opposed to conduction with direct contact, appears to be more significant for thermal injury to occur

Conclusion

AST technology provides significant safety value by removing radiative heat transfer as a possible agent of patient and caregiver harm. This technology significantly and rapidly lowers the temperature of an accidentally disconnected light cord to levels well below the threshold for causing skin injury and drape burns.